CARGO BRIDGE

INTRODUCTION:-

Objective of the game is to build a bridge between two points strong enough to sustain a given weight. The bridge should also be able to sustain its own weight.

HOW TO PLAY:-

To start playing the game, you need to run the "Game.rkt" file. A window pops up where play game would give you three level options. In each level build a bridge by dragging the mouse to the desired location and when it's done, click "Test your bridge" icon present at the top of the window. If by mistake you have made a part which is not required, click on "Delete Bridge" and then click on the part which you want to delete.

PROBLEMS FACED:-

1. One problem was dealing with the physics part as it required taking in account all types of forces e.g. friction, torque etc. We had to do a lot of research to find out how to check for stability of any bridge. Toughness of the topic can be judged by the fact that IIT Kharagpur has a course based on bridge-testing. To make it close to real-life scenario, we had to change the values of mass and strain many times.

2. There were cases when numbers of equations were more than the number of variables. For example, we had 15 equations and 12 variables, then we took all combinations of 12 equations out of those 15, but then it took a long time to run. Then we tried what we had learnt in MA 106 course. We tried to find out all independent equations out of those 15 which obviously would have been less than or equal to 12. This was done by converting the 2d-vector in row-echelon form (also done in Gauss-Jordan Method).

3. In graphics part there was no such significant problem except the part when the user is supposed to build the bridge. He can build anything that comes to his mind. Making it user friendly was main point of concern. Also to animate a falling

bridge is something that we planned to do but could not apply enough physics to figure out the actual mechanism to break it as it seems in real life.

FUNCTIONS:

BRIDGE CLASS:

This class handles everything related to the construction of the bridge. The main function in this class is the build-bridge function that initiates the recursive mechanism of bridge construction by calling the function drag repeatedly.

Row-echelon:

A function which takes as input a matrix of size (n*m), a vector of size n i.e. rhs vector where n>=m, and returns the row echelon form of the matrix and hence solving any general case of no solution, unique solution and infinite solutions of the system of n linear equations in m variables. This function formed the basis of our physics part.

Move-it:

This function required a list of points as the path along which the load will move, the point of first breakage in the bridge , level etc . this function completed the end simulation of the ball moving over the bridge and redirecting the user to play a new game.

Main-fn:

This function calls a variety of functions but the main task is to test the stability of the bridge. Within the same file (eqnsolve.rkt) we have the initial-check to test for initial stability of the bridge. Then there is “deter-case” which handles the stability when number of equations is less than or equal to number of variables. We have a special case when number of variables is one more than number of equations which is taken care by “indeter-case”. The file ”eqnsolve.rkt” contains all the physics related to bridge-testing.

FEATURES OF OUR PROGRAM:-

1. In our program, we have made an equation solver which when given a set of equations and a set of variables (less than or equal to number of equations) will

return the solution (a vector or infinite solutions or no solution). In case of extra variables (often called **redundant** variables) we have employed the **displacement method (of degree 1)** which can handle an extra variable. The folder contains a pdf file related to this.

2. We have made good use of vectors and 2d-vectors (prolific use in Gauss-Jordan method and in graphics). We check for the translational as well as rotational stability of the bridge.

3. For the purpose of graphics, we have extensively used the library “graphics/graphics”.

FURTHER MODIFICATIONS POSSIBLE:-

Some features which could not be added in the game are:

1. When the overall torque acting on the bridge is not zero we simply return a window with a message that bridge is not stable. What we could have done is to rotate that bridge in the influence of that torque and give the bridge a new orientation for the game to continue.

2. Another thing is that in some cases there are more variables than equations to find forces and. We have solved for the case when one variable is extra. We could have added the solution via displacement method of degree 2.

3. In the graphics part, we could have shown the ball falling at the point where load is high. What we have done is stopped the ball at that joint where bridge becomes strenuous and reddened the part which is under stress.

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